

2.0 Identification of High Crash Intersections

2.1 Methodology

This section describes the criteria and calculations used to rank the study intersections. The primary values used are the crash frequency, the crash rate, and the Equivalent Property Damage Only (EPDO) rate. In addition, critical crash rates are calculated to determine statistically high crash intersections. The values can then be used to rank the various intersections by their functional classification and control type.

2.1.1 Crash Frequency

Crash frequency refers to the total number of crashes that occurred at the included intersections in the years 2003 or 2004. It is sometimes used for comparison in crash analysis, but is not recommended since it fails to consider exposure and overall traffic conditions.

2.1.2 Crash Rate

Crash rate for intersections is defined as the ratio of crash frequency over traffic volume for the subject time period. It is expressed in terms of crashes per million entering vehicles (MEV) for an intersection. It has been found to be more reliable for intersections involving local streets since injuries at local intersections tend to be more random and are a result of vehicle size and the use/non-use of seat belts. A one or two day snow/ice event can greatly sway the Crash Rate at a high volume major intersection due to a large number of “fender benders”, but has less impact on the EPDO Rate. The formula used in this study to determine the intersection crash rate is included in Technical Appendix C and F.

2.1.3 Crash Costs and EPDO Rate

As previously discussed, crashes are classified by severity into four categories. These consist of fatal, injury, property damage, and non-reportable crashes. The EPDO rate is a way of expressing the severity of all crashes in terms of a property damage crash. This provides an unbiased way of comparing all crashes and locations, weighting more severe crashes heavily per MEV. It has been found to be the most reliable in ranking intersections of major streets with other major streets or collectors due to higher speed limits. These intersections tend to have a consistently higher percentage of injury/fatal crashes.

The first step is to convert all crashes to property damage crashes. This is accomplished through the use of crash costs provided by the National Safety Council (NSC) for the years 2003 and 2004. The method used to determine the costs for the City of Lincoln can be found in Technical Appendix C and F for the years 2003 and 2004 respectively. The results are summarized on the next page.

2003 Adjusted Average Crash Costs for Lincoln, Nebraska

Fatal Crash	=	\$1,237,895
Injury Crash	=	\$66,655
Property Damage-Only Crash	=	\$8,200
Non-Reportable Crash	=	\$475

$$\begin{aligned} 2003 \text{ Total Cost} &= \$1,237,895 * 19 + \$66,658 * 1,983 + \$8,200 * 5,728 + \$475 * 1,670 \\ &= \$ 203,460,350 \end{aligned}$$

2004 Adjusted Average Crash Costs for Lincoln, Nebraska

Fatal Crash	=	\$1,318,333
Injury Crash	=	\$71,761
Property Damage-Only Crash	=	\$7,400
Non-Reportable Crash	=	\$975

$$\begin{aligned} 2004 \text{ Total Cost} &= \$1,318,333 * 6 + \$71,767 * 1,960 + \$7,400 * 4,496 + \$975 * 2,582 \\ &= \$ 184,348,850 \end{aligned}$$

As mentioned previously, these costs should be considered conservative for crashes involving an injury or fatality, since they represent measurable costs such as wage loss, medical expenses, property damage, and insurance costs. They do not, however, reflect the higher costs persons are willing to incur to avoid crash involvement.

2.1.4 Critical Crash and EPDO Rates

Critical rates are developed as a way to statistically evaluate an intersection. If an intersection rate falls below the critical rate, the number of crashes could be due to normal fluctuations. However, if the crash rate falls above the critical rate, there is a significant difference. This indicates that the difference could be due to more than normal fluctuations. The formula used to determine critical crash and EPDO rates can be found in Technical Appendix C and F.

2.2 Intersection Analysis Procedures

Using the above listed methodology, all intersections with one or more crashes during 2003 and 2004 were evaluated to determine their crash and EPDO rates. **Table 3** shows the results of this analysis for 2003, and **Table 4** shows the results for 2004.

Table 3 – 2003 Intersection Crash Analysis Summary

Functional Classification	Traffic Control	No. Evaluated	Avg No. of Crashes	Avg Crash Rate	Avg EPDO Rate	Ranking Criteria
				Crashes/MEV		
Major/ Major	Signal	180	11.3	0.99	2.46	EPDO Rate
Major/Major	Stop	23	3.1	0.70	2.32	EPDO Rate
Major/Collector	Signal	113	5.3	0.65	1.56	EPDO Rate
Major/Collector	Stop	49	2.6	0.49	1.47	EPDO Rate
Major/Local	Stop	491	2.0	0.41	1.04	Crash Rate
Collector/Collector	Signal	8	1.9	0.38	1.13	EPDO Rate
Collector/Collector	Stop	12	1.9	1.23	3.33	Crash Rate
Collector/Collector	Yield	2	1.5	1.59	1.59	Crash Rate
Collector/Local	Stop	56	1.7	1.11	3.05	Crash Rate
Collector/Local	Yield	14	1.4	1.23	1.76	Crash Rate
Collector/Local	None	33	1.2	1.30	2.46	Crash Rate
Local/Local	Stop	39	1.4	1.85	3.75	Crash Rate
Local/Local	Yield	33	1.3	1.69	3.71	Crash Rate
Local/Local	None	314	1.3	1.92	4.32	Crash Rate

Table 4 – 2004 Intersection Crash Analysis Summary

Functional Classification	Traffic Control	No. Evaluated	Avg No. of Crashes	Avg Crash Rate	Avg EPDO Rate	Ranking Criteria
				Crashes/MEV		
Major/Major	Signal	177	12.4	1.05	2.27	EPDO Rate
Major/Major	Stop	20	3.6	0.56	1.40	EPDO Rate
Major/Collector	Signal	108	5.7	0.67	1.56	EPDO Rate
Major/Collector	Stop	48	2.8	0.54	1.12	EPDO Rate
Major/Local	Stop	469	2.0	0.43	1.00	Crash Rate
Collector/Collector	Signal	9	2.7	0.51	0.89	EPDO Rate
Collector/Collector	Stop	8	2.1	1.37	3.29	Crash Rate
Collector/Collector	Yield	1	1.0	0.45	2.64	Crash Rate
Collector/Local	Stop	46	1.7	1.08	2.14	Crash Rate
Collector/Local	Yield	13	1.2	0.86	2.29	Crash Rate
Collector/Local	None	30	1.1	0.99	2.32	Crash Rate
Local/Local	Stop	31	1.8	2.11	4.07	Crash Rate
Local/Local	Yield	39	1.5	1.98	4.64	Crash Rate
Local/Local	None	303	1.2	1.82	3.78	Crash Rate

As shown above, major/major intersections recorded the highest number of crashes. However, the local and collector streets generally had the higher crash and EPDO rates. This is primarily due to the difference in traffic volumes and control at the various intersections.

2.3 Priority and Ranking of High Crash Intersections

To implement a safety program that is effective, high crash locations must be identified, and appropriate countermeasures implemented where they will derive the greatest benefit. There are presently several criteria used nationally to identify high crash locations, however for this report the “Rate Quality – Control” method was used.

Although all intersections that recorded a crash within the City of Lincoln were considered and screened, detailed studies were only performed on intersections that were identified as statistically high crash locations. Following is the “Rate Quality – Control” method that was used to rank these intersections.

1. An alphabetical list of intersections was prepared.
2. All reported crashes were identified for each intersection and the intersection Crash Rate and EPDO Rate were calculated.
3. Based upon the commonly accepted assumption that crashes fit the Poisson distribution, critical crash and EPDO rates were calculated for each intersection for a 95% confidence level.
4. Intersections where either the Crash or EPDO Rates exceeded the critical rate were identified and prioritized in descending order according to their ranking criteria. The ranking criteria for each functional classification and control type are provided in **Tables 3 and 4**.

Based upon the “Rate Quality – Control” method, 59 intersections out of 1,374 in 2003 and 68 intersection out of 1,311 in 2004 evaluated were determined to have either Crash or EPDO Rates that exceeded their critical rates for other locations in Lincoln with similar control type and functional classification. These intersections are listed in **Tables 5 and 6**, and are shown geographically on **Figures 19 and 20** for years 2003 and 2004 respectively.

Collision diagrams were used to analyze the intersections to identify crash patterns. For intersections previously studied, the crash history was used to further analyze crash patterns which may still exist in the analysis years. A review of on-site features was also conducted for all study intersections.

The number of crashes was categorized according to the crash severity. The total number of crashes that involved a fatality or injury is represented by “F + I”. The total number of property damage crashes at each location is shown in the column titled “PD”, while non-reportable crashes are listed under “NR”.

Table 5 – Ranking of 2003 High Crash Intersections

Rank	Intersection	Number of Crashes				EPDO Rate Crash/MEV	Crash Rate Crash/MEV
		F+I	PD	NR	Total		

Major/Major Signalized Intersections

1	Nebraska Hwy 2 & 27 th St	15	23	8	46	8.42	2.34
2	Nebraska Hwy & 84 th St	4	8	0	12	7.92	2.07
3	Pine Lake Rd & 27 th St	4	8	3	15	7.70	2.51
4	Vine St & 27 th St	13	18	5	36	7.37	1.88
5	Nebraska Hwy 2 & 56 th St	10	10	5	25	6.97	1.66
6	Nebraska Hwy 2 & 70 th St	4	8	1	13	6.96	1.97
7	“K” St & 17 th St	7	15	0	22	6.86	1.85
8	“O” St & 27 th St	13	23	4	40	6.62	1.81
9	Cornhusker Hwy & 48 th St	7	11	3	21	6.25	1.69
10	Capitol Pkwy & Homestead Expwy	6	7	4	17	5.85	1.55
11	Holdrege St & 27 th St	9	16	4	29	5.59	1.60
12	Old Cheney Rd & 27 th St	5	23	6	34	5.56	2.67
13	“A” St & 48 th St	5	8	1	14	5.45	1.37
14	Cornhusker Hwy & Havelock Ave	6	10	4	20	5.29	1.57
15	Nebraska Hwy 2 & 14 th St	9	17	4	30	4.78	1.40
16	“O” St and 48 th St	8	27	9	44	4.58	1.95
17	Cornhusker Hwy & 27 th St	8	23	5	36	4.24	1.54

Major/Major Stop Controlled Intersections

1	Yankee Hill Rd and 27 th St	1	1	0	2	17.95	3.42
2	Havelock Ave & 84 th St	4	4	1	9	7.10	1.52

Major/Collector Signalized Intersections

1	Ridge Line Rd & 27 th St	2	4	0	6	13.25	3.46
2	Beaver Creek Ln & Pine Lake Rd	5	3	0	8	12.85	2.04
3	Centennial Mall & “O” St	7	5	2	14	8.59	1.68
4	Elkcrest Dr & 56 th St	3	8	0	11	3.94	1.19
5	“K” St & 14 th St	2	8	1	11	3.68	1.50
6	St Paul Ave & 48 th St	3	7	2	12	3.54	1.19
7	Tipperary Trl & 27 th St	2	5	2	9	3.50	1.31
8	Knox St & 27 th St	4	8	2	14	3.34	1.01
9	“O” St and 1 st St	3	5	4	12	3.30	1.18
10	Calvert St & 56 th St	2	10	0	12	3.04	1.26

*Bold text indicates the ranking criteria.

Table 5 – Ranking of 2003 High Crash Intersections (Continued)

Rank	Intersection	Number of Crashes				EPDO Rate Crash/MEV	Crash Rate Crash/MEV
		F+I	PD	NR	Total		

Major/Collector Stop Controlled Intersections

1	Lake St & 17 th St	4	1	0	5	9.61	1.23
2	Capitol Pkwy & Folsom St	2	6	1	9	4.42	1.59
3	Holdrege St & 40 th St	2	6	1	9	3.27	1.18

Major/Local Stop Controlled Intersections

1	“P” St and 21 st St	8	5	1	14	23.84	4.12
2	Pioneers Blvd & Stacy Ln	4	2	0	6	24.05	3.61
3	Sweetbriar Ln & 40 th St	2	7	1	10	4.92	1.89
4	Stacy Ln & 70 th St	5	5	1	11	8.71	1.83
5	Leighton Ave & 63 rd St	1	3	0	4	5.70	1.83
6	“A” St & 18 th St	1	6	1	8	3.43	1.77
7	Centerpark Rd & 14 th St	1	9	5	15	2.18	1.75
8	“Q” St & 21 st St	3	2	0	5	10.43	1.71
9	“Q” St & 25 th St	2	2	1	5	7.20	1.71
10	Vine St & 25 th St (East Junction)	4	7	0	11	6.67	1.63
11	Vine St & 25 th St (West Junction)	2	6	3	11	3.73	1.63
12	Van Dorn St & 79 th St	1	4	0	5	3.93	1.46
13	“Q” St and 19 th St	1	3	0	4	4.28	1.37
14	Old Dairy Rd & 27 th St	2	2	1	5	5.41	1.29
15	“H” St & 13 th St	1	4	0	5	3.16	1.17
16	Adams St & 44 th St	3	2	1	6	5.93	1.17
17	Washington St & 16 th St	1	3	0	4	3.60	1.15
18	Antelope Creek Rd & 48 th St	4	3	1	8	4.28	0.83

Collector/Local Stop Controlled Intersections

1	“D” St & 11 th St	4	2	0	6	36.47	5.48
2	“R” St & 19 th St	2	4	0	6	14.30	3.74
3	“R” St & 23 rd St	2	3	0	5	13.68	3.11

Local/Local Stop Controlled Intersections

1	“F” St & 11 th St	1	2	2	5	15.89	6.85
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Local/Local No Control

1	Whitehead Dr & Telluride Dr	3	1	1	5	80.85	13.70
2	“Y” St & 42 nd St	3	2	0	5	41.72	6.85
3	“E” St & 23 rd St	2	2	0	4	28.72	5.48
4	“C” St & 19 th St	2	2	0	4	28.72	5.48
5	Lowell Ave & 52 nd St	1	3	0	4	17.10	5.48

*Bold text indicates the ranking criteria.

Table 6 – Ranking of 2004 High Crash Intersections

Rank	Intersection	Number of Crashes				EPDO Rate Crash/MEV	Crash Rate Crash/MEV
		F+I	PD	NR	Total		

Major/Major Signalized Intersections

1	Pioneers Blvd & 70 th St	10	20	7	37	11.53	3.47
2	Van Dorn St & 70 th St	11	12	4	27	10.74	2.32
3	“O” St & 33 rd St	17	14	8	39	9.82	2.03
4	Randolph St & 48 th St	8	7	3	18	9.63	1.95
5	Cornhusker Hwy & Link 55X/56 th St	7	5	3	15	9.36	1.83
6	Holdrege St & 56 th St	9	11	1	21	9.05	1.84
7	“O” St & 48 th St	16	20	15	51	8.20	2.26
8	Cornhusker Hwy & 27 th St	16	17	19	52	7.82	2.22
9	Vine St & 27 th St	13	13	7	33	7.64	1.72
10	“A” St & 27 th St	8	10	6	24	7.42	1.93
11	Nebraska Hwy 2 & 27 th St	11	23	17	51	6.99	2.59
12	“P” St & 27 th St	8	13	4	25	6.97	1.83
13	Nebraska Hwy 2 & Old Cheney Rd	6	10	6	22	6.73	2.05
14	“O” St & 27 th St	12	23	15	50	6.67	2.26
15	Nebraska Hwy 2 & 40 th St	8	19	5	32	6.63	2.09
16	Capitol Pkwy & Homestead Expwy	6	9	3	18	6.44	1.64
17	Warlick Blvd & Old Cheney Rd	5	6	4	15	6.25	1.63
18	Nebraska Hwy 2 & 56 th St	8	11	7	26	6.21	1.72
19	Vine St & 48 th St	9	13	6	28	6.14	1.63
20	Pine Lake Rd & 27 th St	3	5	2	10	6.00	1.67
21	Nebraska Hwy 2 & 70 th St	3	8	1	12	5.87	1.82
22	“A” St & 48 th St	4	13	3	20	5.33	1.96
23	Cornhusker Hwy & 11 th St	6	11	12	29	5.13	2.01
24	“A” St & 48 th St	6	17	4	27	4.68	1.60
25	“O” St & 17 th St	6	15	6	27	4.42	1.55
26	“O” St & 10 th St	5	21	10	36	4.28	2.10
27	Nebraska Hwy 2 & 14 th St	7	18	13	38	4.25	1.77

Major/Major Stop Controlled Intersections

1	Coddington Ave & Van Dorn St	2	5	1	8	7.96	2.49
2	Cotner Blvd & 70 th St (South Jctn)	1	0	2	3	3.96	1.13
3	Normal Blvd & 70 th St	2	4	3	9	2.68	0.97

Major/Collector Signalized Intersections

1	Ridge Line Rd & 27 th St	2	1	1	4	12.43	2.31
2	Elkcrest Dr & 56 th St	8	8	1	17	9.71	1.84
3	Knox St & 27 th St	10	10	1	21	8.14	1.52
4	“O” St & 52 nd St	8	8	2	18	6.41	1.28
5	“O” St & 14 th St	5	4	4	13	5.85	1.37

*Bold text indicates the ranking criteria.

Table 6 – Ranking of 2004 High Crash Intersections (Continued)

Rank	Intersection	Number of Crashes				EPDO Rate <i>Crash/MEV</i>	Crash Rate <i>Crash/MEV</i>
		F+I	PD	NR	Total		
Major/Collector Signalized Intersections Continued							
6	“O” St & 11th St	3	7	3	13	4.37	1.49
7	“O” St & 25 th St	4	6	7	17	3.84	1.37
8	“M” St & 9 th St	2	12	2	16	3.34	1.64

Major/Collector Stop Controlled Intersections

1	Fremont St & 66 th St	4	2	0	6	11.68	1.64
2	Adams St & 1 st St	3	3	2	8	7.58	1.79

Major/Local Stop Controlled Intersections

1	Meridian Dr & Fletcher Ave	1	0	1	2	37.79	7.31
2	Old Cheney Rd & 88 th St	1	1	0	2	23.63	4.21
3	Porter Ridge Rd & 27 th St	1	1	1	3	15.94	4.21
4	Pioneers Blvd & Stacy Ln	4	1	0	5	25.20	3.01
5	Old Dairy Rd & 27 th St	1	6	2	9	4.24	2.32
6	Southridge Rd & 27 th St	1	3	0	4	7.62	2.31
7	Washington St & 16 th St	2	5	1	8	7.37	2.31
8	Leighton Ave & 63 rd St	1	3	1	5	6.09	2.28
9	“A” St & 8 th St	3	1	0	4	14.45	1.83
10	“K” St & 20 th St	4	5	2	11	7.48	1.78
11	“Q” St & 23 rd St	4	1	0	5	14.33	1.71
12	Thatcher Ln & NW 48 th St	1	2	2	5	4.19	1.68
13	Adams St & 44 th St	3	5	0	8	6.92	1.55
14	“P” St & 19 th St	1	4	0	5	4.19	1.47
15	Centerpark Rd & 14 th St	2	4	6	12	2.93	1.40
16	“Q” St & 19 th St	1	1	2	4	3.93	1.37
17	Stacy Ln & 70 th St	2	6	0	8	4.39	1.33
18	“A” St & 18 th St	3	3	0	6	7.43	1.33
19	“E” St & 16 th St	2	3	0	5	6.11	1.30
20	“P” St & 21 st St	1	3	0	4	3.89	1.18
21	Claremont St & 10 th St	2	2	1	5	5.02	1.11
22	Vine St & 35 th St	4	4	1	9	5.55	1.11
23	Vine St & 22 nd St	3	4	0	7	5.07	1.03
24	“O” St & 18 th St	3	6	1	10	3.28	0.89

Collector/Local Stop Controlled Intersections

1	“Y” St & 26 th St	1	2	1	4	10.57	3.42
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Local/Local Yield Controlled Intersections

1	Baldwin Ave & 41 st St	3	1	0	4	43.34	5.48
2	“W” St & 26 th St	2	2	0	4	30.72	5.48

Local/Local No Control

1	“T” St & 30 th St	1	4	1	6	19.65	8.22
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*Bold text indicates the ranking criteria.

Figure 19 – 2003 High Crash Intersection Locations

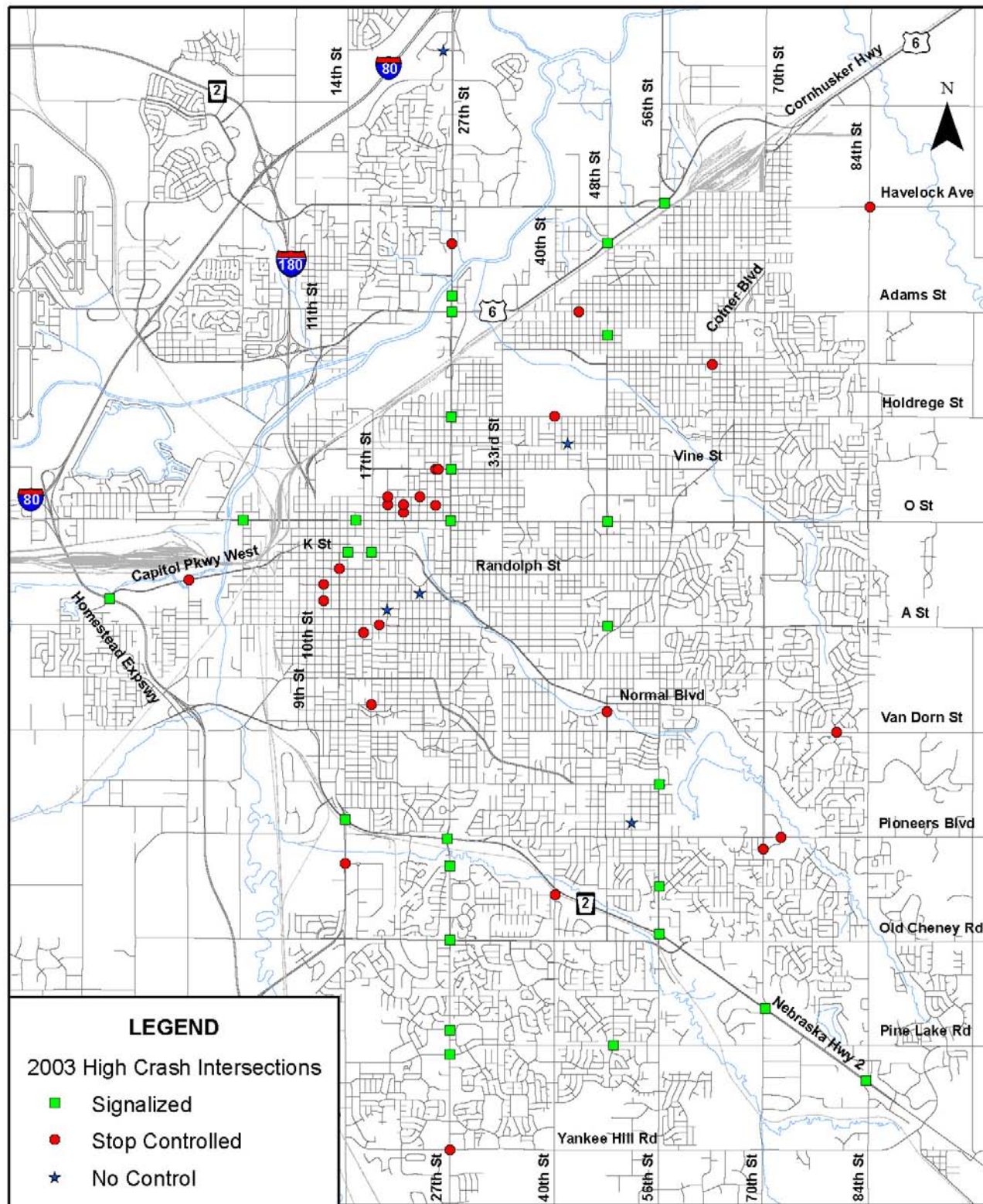


Figure 20 – 2004 High Crash Intersection Locations

